

## Taxonomic revision of the spider genus *Ryuthela* (Araneae: Liphistiidae)

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**Abstract** — The spider genus *Ryuthela* was taxonomically revised. Male palpal structure is employed for morphological examination because the structure of female receptacle is an unreliable taxonomic character due to its large variation. Four of seven known species, *R. nishihirai*, *R. iheyana*, *R. sasakii*, and *R. ishigakiensis* were remained as independent species. *Ryuthela secundaria* and *R. owadai* were newly synonymized with *R. sasakii*, and *R. tanikawai* was synonymized with *R. ishigakiensis*. The male of *R. iheyana* was described for the first time.

**Key words** — taxonomy, new synonymy, Ryukyu, Okinawa

### Introduction

The genus *Ryuthela* comprises seven species described from Ryukyu Isls., south west Japan (Haupt 1979, 1983; Ono 1997, 2001, 2002), and endemic to this region. Although three of these species were described using only female specimens (Ono 1997, 2002), the shape of the female receptacle of this group is highly variable and hence unreliable as a taxonomic character (Haupt 2003). The great variety of the female receptacle seemed to be overlooked due to a paucity of specimens for examination. It is important for delimitation of the morphological species to examine sufficient number of specimens and verify the range of the morphological variation within a population as well as to find gaps among populations. In this study, I examined many specimens collected from all the distribution range of *Ryuthela* (Fig. 1) to clarify the morphological variations and morphological gaps within and among populations. As a result, I found a great intra-population variety in female receptacle, while much less variations in the shape of male palp. Thus, I regarded male palpal characters can be used for taxonomic identification. From the morphological gap among the male specimens, I concluded that it is appropriate to recognize four species in the genus *Ryuthela*, namely, *R. nishihirai*, *R. iheyana*, *R. sasakii* and *R. ishigakiensis*.

All the specimens examined in this study were collected by Akio Tanikawa unless otherwise noted. The voucher specimens will be deposited in the collection of the Department of Zoology, National Museum of Nature and Science, Tokyo. The terminology used in this paper is the same as in Schwendinger & Ono (2011).

### Taxonomy

Family Liphistiidae Thorell 1869

[Japanese name: Harafushigumo-ka]

Genus *Ryuthela* Haupt 1983

[Japanese name: Okinawa-kimuragumo-zoku]

*Ryuthela nishihirai* (Haupt 1979)

[Japanese name: Okinawa-kimura-gumo]

(Figs. 1, 2A–C, 3A–C, 4A–C)

*Heptathela nishihirai* Haupt 1979, p. 356, figs. 6a–d, 7a–b, 8a–b, 9a–c, 10, 12a–c. [male holotype from Okinawajima Is., deposited in Zoologisches Museum Hamburg, not examined]; Yaginuma 1979, p. 1, fig. 2; Yaginuma 1980, p. 44, fig. 2; Yaginuma 1986, p. 2, figs. 1–2; Chikuni 1989, p. 18, fig. 2.

*Ryuthela nishihirai* Haupt 1983, p. 286, figs. 9g–h, 10a–b, 11b, 12b, 12e, 13g; Haupt 2003, p. 71, figs. 43H, 48A–B, 52A–B, 53.1–24, 55.7–9, 62A; Ono 2009, p. 80, figs. 26–32.

**Specimens examined.** OKINAWAJIMA IS. 1♀, near Mt. Yonahadake (N26.71531 E128.22219), 12-XI-2005. 5♀, Jahana, Motobu-cho (N26.68187 E127.89890), 17-XI-2007. 2♀, Kogachi, Nago-shi (N26.62611 E127.99059), 17-VI-2007. 4♀, Genka, Nago-shi (N26.62398 E128.06210), 16-XI-2007. 2♀, Awa, Nago-shi (N26.61970 E127.91851), 17-XI-2007. 3♀, Gesashi, Higashi-son (N26.60621 E128.14336), 23-X-2006. 5♀, Nago, Nago-shi (N26.58921 E127.99792), 14-VI-2006. 2♀, Teniya, Nago-shi (N26.57086 E128.12697), 16-XI-2007. 1♀, Sukuta, Nago-shi (N26.56284 E127.98829), 20-X-2006. 2♀, Sedake, Nago-shi (N26.55508 E128.05146), 16-XI-2007. 2♀, Abu, Nago-shi (N26.54453 E128.08456), 17-II-2008. 5♂1♂, Kushi, Nago-shi (N26.52048 E128.01381), male was collected as juvenile on 25-V-2010 and became adult on 8-IX-2010. 1♂, Nago-shi, 7-IX-2010. 2♀, Afuso, On-na-son

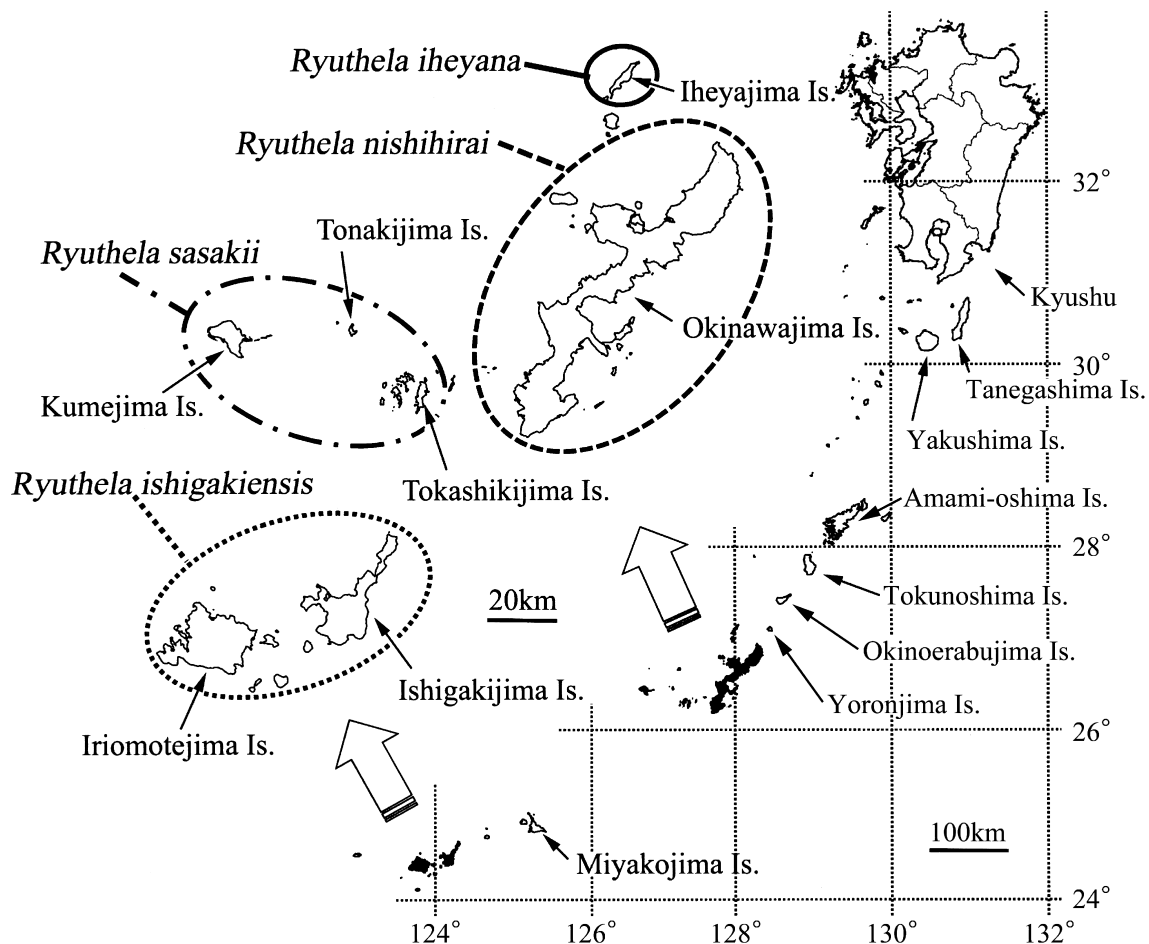


Fig. 1. Map showing distribution area of *Ryuthela*.

(N26.50046 E127.91703), 14-VI-2006. 12♀, Tancha, On-na-son (N26.46752 E127.83551), 11-XI-2005 (7♀), 22-X-2006 (5♀). 2♂, same locality, collected as juvenile on 25-V-2010 and became adult on 8-IX-2010. 4♀, Matsuda, Ginoza-son (N26.48550 E127.98256), 16-III-2008. 1♀, On-na, On-na-son (N26.46714 E127.84935), 19-XI-2006. 1♀, Kin, Kin-cho (N26.46516 E127.93448), 16-III-2008. 5♀7♂, Ishikawa-yamashiro, Uruma-shi (N26.42298 E127.78798), males were collected as juvenile on 24-V-2010 and became adult on 8-IX-2010 (4♂), 17-IV-2011 (1♂), 4-XI-2012 (1♂), and 10-XI-2012 (1♂). 1♀, Uken, Uruma-shi (N26.37818 E127.86875), 16-VI-2008. 2♀4♂, Chibana, Okinawa-shi (N26.36363 E127.81112), males were collected as juvenile on 25-V-2010 and became adult on 8-IX-2010 (3♂) and 27-IV-2011 (1♂). 1♀, Katsuren-haebaru, Uruma-shi (N26.33230 E127.87889), 17-III-2008. 6♀, Sonoda, Okinawa-shi (N26.32730 E127.80252), 19-XI-2006. 2♀, Ogusuku, Kita-nakagusuku-son (N26.28550 E127.80430), 19-XI-2007. 1♀, Kakazu, Ginowan-shi (N26.25936 E127.73562), 16-VI-2008. 1♀, Sueyoshi-koen, Naha-shi, (N26.22728 E127.71526), 10-VI-2005. 1♀, Tamagusuku-itokazu, Nanjo-shi (N26.15155 E127.76369), 15-VI-2008.

**Remarks.** The shapes of male palps of *R. nishihirai* and

*R. iheyana* are closely resembled, but they can be separated by the following points. In distal view, the distal part of contrategulum is blunt in *R. nishihirai* but rather sharp in *R. iheyana* (Figs. 2A-F, arrows 1), and width between basal part of embolus and distal part of marginal apophysis of tegulum is wider in *R. nishihirai* than *R. iheyana* (Figs. 2A-F, arrows 2). In retrolateral view, marginal apophysis of tegulum is larger in *R. nishihirai* than in *R. iheyana* (Fig. 3A-F, arrows 3).

**Distribution.** Okinawajima Is., Ryukyu Is., southwest Japan.

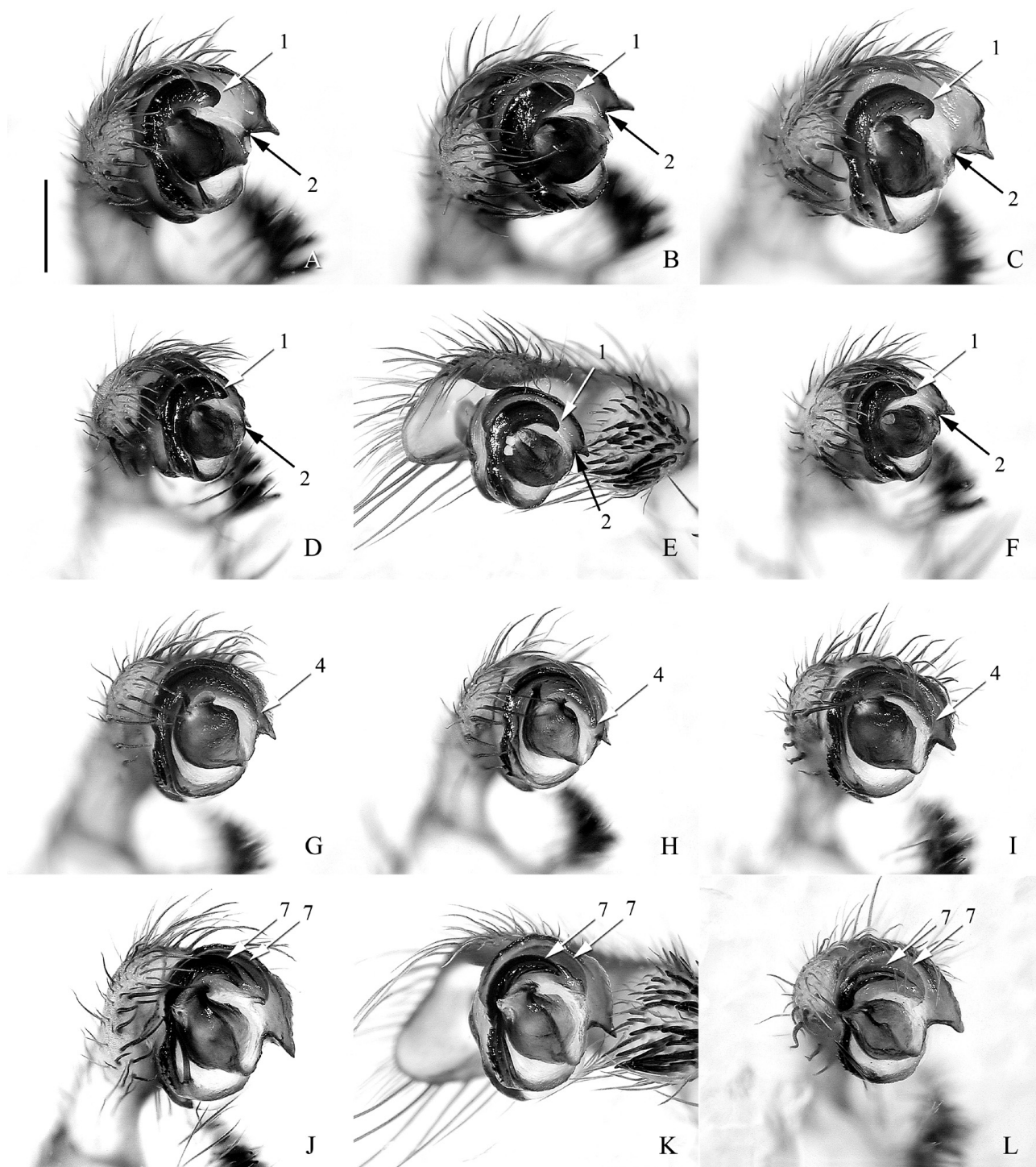
*Ryuthela iheyana* Ono 2002

[Japanese name: Iheya-kimura-gumo]

(Figs. 1, 2D-F, 3D-F, 4D-F, 5, 6A-E)

*Ryuthela iheyana* Ono 2002, p. 52, figs. 1-3; Ono 2009, p. 80, figs. 1, 7-8. [Female holotype from Iheyajima Is., deposited in National Museum of Nature and Science, Tokyo, not examined.]

**Specimens examined.** IHEYAJIMA IS. 2♀, Tana (N27.04599 E127.95997), 12-XI-2007. 1♀, Tana, (N27.04546 E127.95872), 12-XI-2007. 7♀, Gakiya



**Fig. 2.** Genital bulb of male palps, distal view. A–C, *Ryuthela nishihirai* from Okinawajima Is.; D–F, *Ryuthela iheyana* from Iheyajima Is.; G–I, *Ryuthela sasakii* from Kumejima Is. (G), Tonakijima Is. (H), and Tokashikijima Is. (I); J–L, *Ryuthela ishigakiensis* from Ishigakijima Is. (J–K), and Iriomotejima Is. (L). Scale = 0.5 mm.

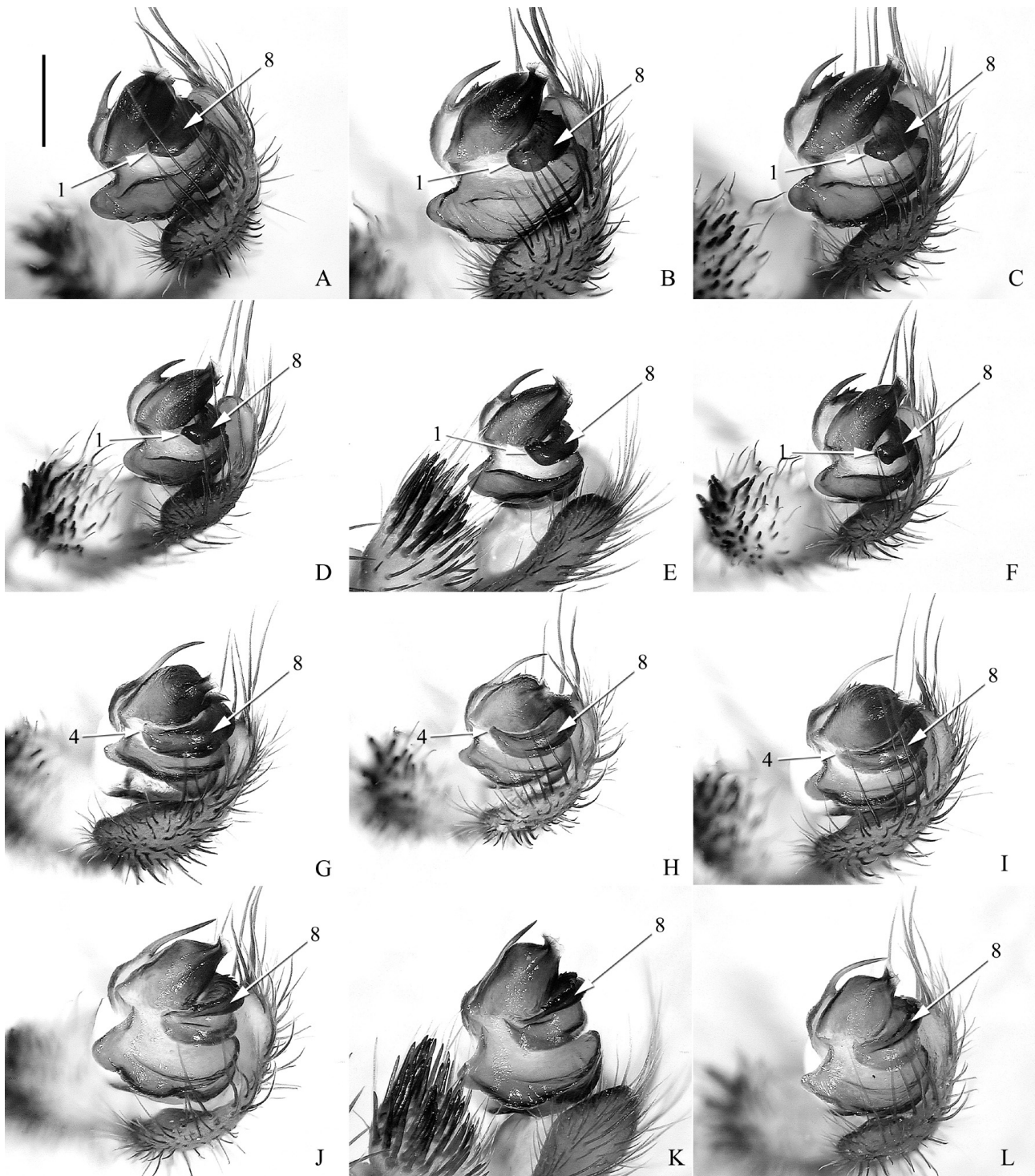
(N27.04178 E127.95813), 12-XI-2007. 1♀, Gakiya (N27.04126 E127.96166), 13-XI-2007. 4♂, same locality, 12-IX-2011. 1♂, Gakiya (N27.03299 E127.95514), 11-IX-2011.

**Description of male.** Based on 1♂ from Iheyajima Is. (Fig. 5). Coloration and markings. Carapace pale brown,

head region anteriorly darker. First metatarsus retrolaterally reddish. Abdomen pale brown mottled with dark brown.

**Measurements.** Measurements are in mm with its range in parentheses. Body 8.40 (7.70–9.10) long. Carapace 4.13 (4.13–4.75) long; 3.44 (3.44–4.06) wide. Length of legs [tarsus + metatarsus + tibia + patella + femur = total]: I,



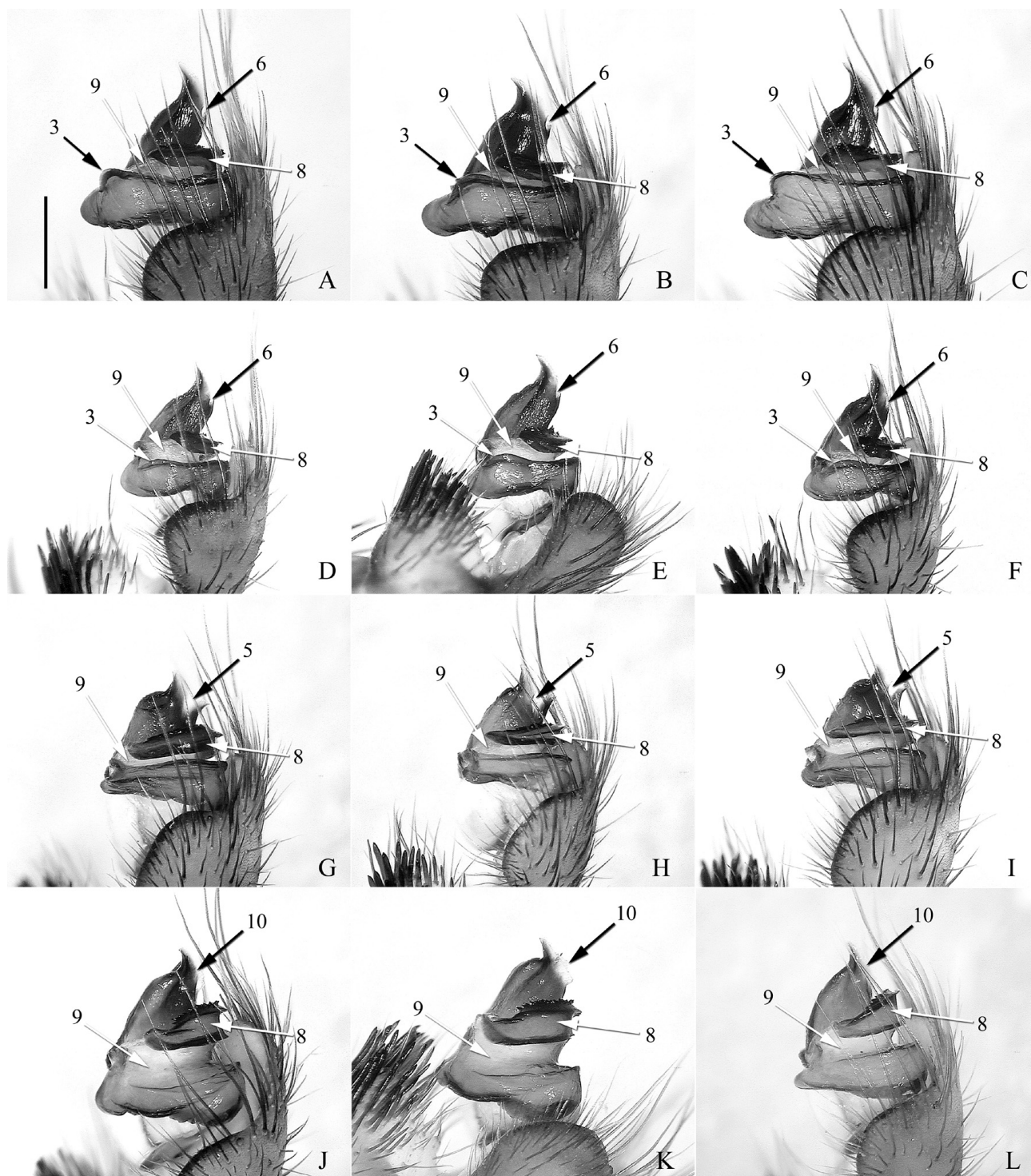


**Fig. 3.** Genital bulb of male palps, letrolateral view. A-C, *Ryuthela nishihirai* from Okinawajima Is.; D-F, *Ryuthela iheyana* from Iheyajima Is.; G-I, *Ryuthela sasakii* from Kumejima Is. (G), Tonakijima Is. (H), and Tokashikijima Is. (I); J-L, *Ryuthela ishigakiensis* from Ishigakijima Is. (J-K), and Iriomotejima Is. (L). Scale=0.5 mm.

2.00 + 3.63 + 2.66 + 1.75 + 4.03=14.07; II, 2.13 + 3.88 + 2.63 + 1.75 + 3.75=14.14; III, 2.38 + 4.38 + 2.69 + 1.69 + 4.69=15.83; IV, 3.19 + 5.75 + 3.44 + 1.81 + 4.56=18.75. Abdomen 2.48 (2.08-2.94) long; 2.48 (2.08-2.94) wide.

Carapace longer than wide [length/width 1.20 (1.13-

1.20)]. Eye area wider than long [length/width 0.79 (0.76-0.93)]. Fang furrow of chelicera with 10 anterior marginal teeth and no retromarginal teeth. Labium wider than long [length/width 0.45 (0.45-0.56)]. Sternum longer than wide [length/width 1.78 (1.78-2.16)]. Length of leg I/length of carapace 3.41 (3.20-3.41). Male palp (D-F in Figs. 5-7):



**Fig. 4.** Genital bulb of male palps, diagonal view. A–C, *Ryuthela nishihirai* from Okinawajima Is.; D–F, *Ryuthela iheyana* from Iheyajima Is.; G–I, *Ryuthela sasakii* from Kumejima Is. (G), Tonakijima Is. (H), and Tokashikijima Is. (I); J–L, *Ryuthela ishigakiensis* from Ishigakijima Is. (J–K), and Iriomotejima Is. (L). Scale=0.5 mm.

without conductor; with a long contrategular spine. Abdomen longer than wide [length/width 1.45 (1.33–1.54)].

**Remarks.** The shape of male palp of *R. iheyana* closely resembles that of *R. nishihirai*. For the discriminating points, see the remarks of *R. nishihirai*. The shapes of receptacles in *R. iheyana* are highly variable (Fig. 6A–E) as

well as in other species (Figs. 6F–Y; Haupt 2003, figs. 53–54), indicating that female receptacles should not be used for identification.

**Distribution.** Iheyajima Is., Ryukyu Is., southwest Japan.



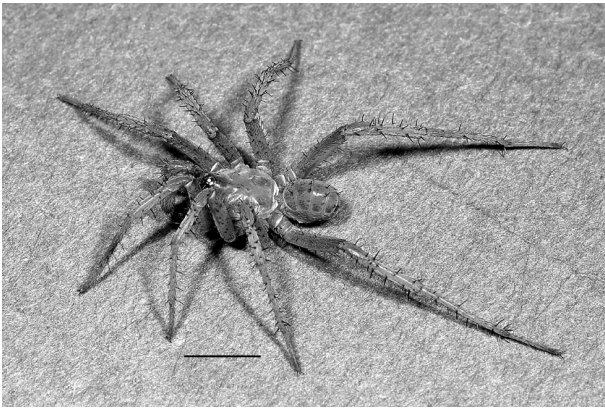


Fig. 5. Male of *Ryuthela iheyana*. Scale = 5 mm.

*Ryuthela sasakii* Ono 1997  
[Japanese name: Kumejima-kimura-gumo]  
(Figs. 1, 2G-I, 3G-I, 4G-I, 6F-Y)

*Ryuthela sasakii* Ono 1997, p. 151, figs. 1–8. [female holotype from Kumejima Is., deposited in National Museum of Nature and Science, Tokyo, not examined.]; Ono 2009, p. 80, figs. 9–14.

*Ryuthela secundaria* Ono 1997, p. 153, figs. 9–10. [female holotype from Kumejima Is., deposited in National Museum of Nature and Science, Tokyo, not examined]; Ono 2009, p. 80, figs. 15–18. **NEW SYNONYMY**

*Ryuthela owadai* Ono 1997, p. 155, figs. 15–18. [male holotype from Tokashikijima Is., deposited in National Museum of Nature and Science, Tokyo, not examined]; Ono 2001, p. 151, figs. 1–3; Ono 2009, p. 80, figs. 19–25; Schwendinger & Ono 2011, p. 616, figs. 48–50. **NEW SYNONYMY**

**Specimens examined.** KUMEJIMA IS. 1♀, Hiyajo (N26.38072 E126.78102), 22-VI-2006. 3♀, Uegusuku (N26.38026 E126.76146), 28-V-2010. 4♀, Uegusuku (N26.37611 E126.77133), 22-VI-2006. 4♀, Kitahara (N26.36829 E126.73401), 21-VI-2006. 1♀2♂, same locality, 28-V-2010, males are collected as juveniles and became adult on 25-IX-2010 and 1-X-2010. 5♀, Aka (N26.36602 E126.79703), 21-VI-2006. 2♀, Kanegusuku (N26.36346 E126.77384), 22-VI-2006. 4♀, Nishime (N26.36192 E126.75940), 20-VI-2006. 4♂, same locality, collected as juveniles on 27-V-2010 and became adult on 25-IX-2010 and 7-X-2010. 5♀, Nishime (N26.35968 E126.76276), 20-VI-2006. 2♀, Maja (N26.34790 E126.80312), 31-VI-2006. 3♂, same locality, collected as juveniles on 28-V-2010 and became adult on 1-X-2010 (2♂) and 13-I-2013 (1♂). 1♀, Gima (N26.32408 E126.77513), 30-V-2010. 5♀, Gima (N26.33529 E126.77486), 22-VI-2006. 2♀, Zenda (N26.32006 E126.80475), 22-VI-2006. 1♀, Zenda (N26.31601 E126.78305), 20-VI-2006. 1♂, same locality, 28-V-2010, collected as juvenile and became adult on 18-IX-2010. 5♀1♂, Shimajiri, (N26.31096 E126.78717), 30-V-

2010, male was collected as juvenile and became adult on 7-X-2010. 5♀, Shimajiri (N26.30910 E126.79753), 22-VI-2006. 1♀5♂, same locality, 28-V-2010, males were collected as juveniles and became adult on 25-IX-2010 and 1-X-2010. TONAKIJIMA IS. 8♀2♂, Tonaki-son (N26.35519 E127.14556), 17-VI-2006, males were collected as juveniles and became adult on 1-X-2006. TOKASHIKIJIMA IS. 5♀5♂, Tokashiki (N26.18993 E127.36524), 10-IX-2011. 3♀4♂, Aharen (N26.17419 E127.34722), 9-IX-2011, three males were collected as juveniles and became adult on 16-IX-2011, 25-IX-2011, 15-X-2011.

**Remarks.** Ono (1997) mentioned that *R. sasakii* and *R. secundaria* could be separated by the number of receptacles, but the number or shapes of receptacles have a great variation as in Figs. 6F–Y, and morphological gap could not be recognized. The male palps of the specimens from Kumejima Is., Tonakijima Is. and Tokashikijima are exactly agree with one another (Figs. 2G–I, 3G–I, 4G–I). The shape of embolus or contrategulum, which can be used for separating the species of this genus, have no difference at all. Ono (1997) also mentioned that *R. owadai* is closely related to *R. nishihirai* and they can be separated by the shape of male palp. However *R. owadai* cannot be separated from *R. sasakii* (not *nishihirai*) by the male palp. Consequently, I consider *R. secundalia* and *R. owadai* are junior synonyms of *R. sasakii*.

The male palp of *R. sasakii* is unique and easily distinguished from *R. nishihirai* and *R. iheyana*. In distal view, the contrategulum is longer than those of *R. nishihirai* or *R. iheyana* (Figs. 2A–I, arrows 1, 4). The embolus of *R. sasakii* has longitudinal constriction and looks like bifurcated (Figs. 3G–I, arrows 5), but those of *R. nishihirai* and *R. iheyana* not (Figs. 3A–F, arrows 6). As for the discriminating point from *R. ishigakiensis*, see the remarks of the latter.

**Distribution.** Kumejima Is., Tonakijima Is. and Tokashikijima Is., Ryukyu Is., southwest Japan.

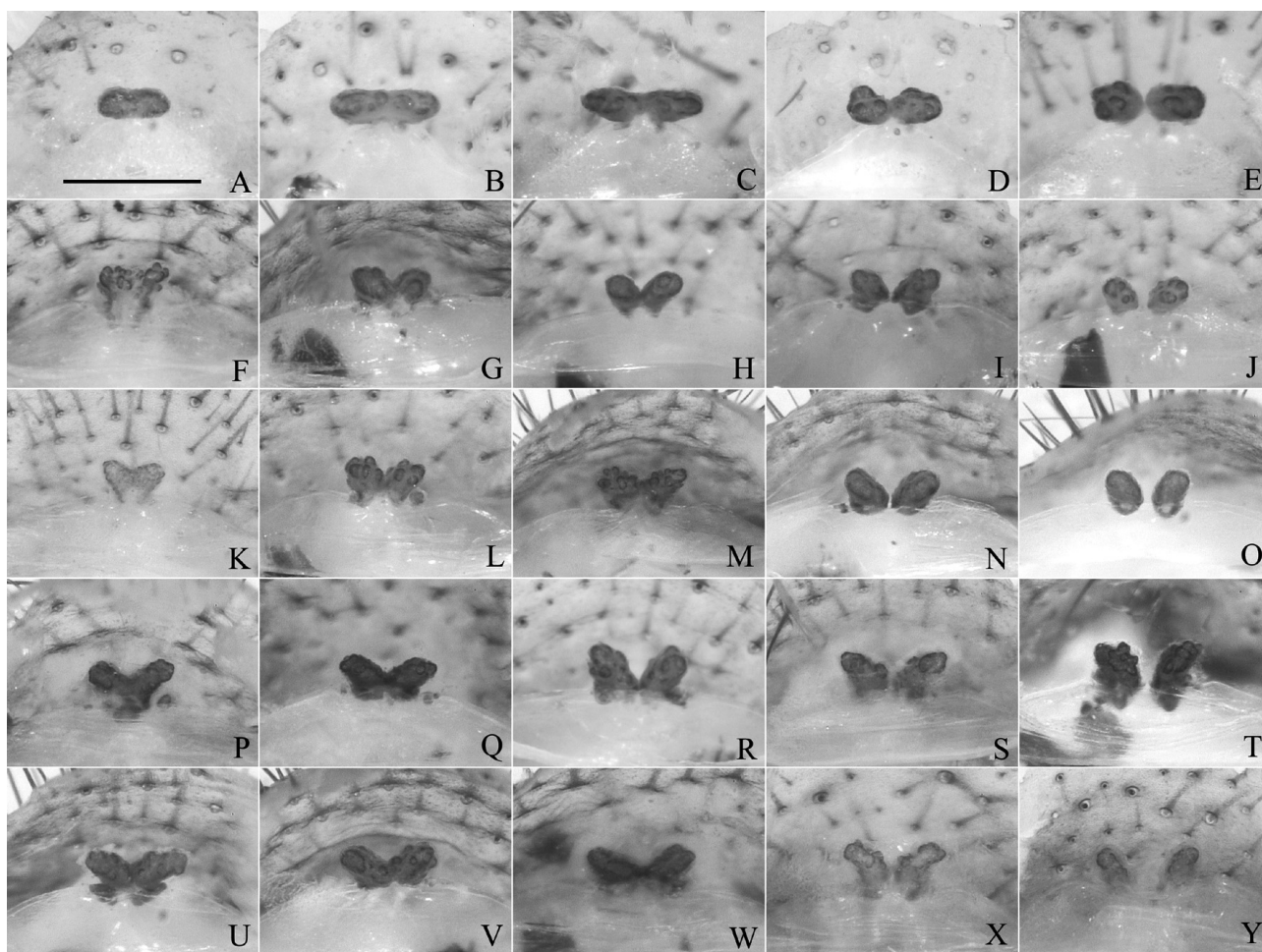
*Ryuthela ishigakiensis* Haupt 1983  
[Japanese name: Ishigaki-kimura-gumo]  
(Figs. 1, 2J–L, 3J–L, 4J–L)

*Ryuthela nishihirai ishigakiensis* Haupt 1983, p. 287, figs. 9f, 10c–d, 12f, 13h. [male holotype from Ishigakijima Is., deposited in Zoologisches Museum Hamburg, not examined]; Haupt 2003, p. 71, figs. 48C–D, 52C–E, 53.25–33, 62B.

*Ryuthela ishigakiensis* Ono 1997, p. 150 (elevated from subspecies); Ono 2009, p. 80, figs. 33–37.

*Ryuthela tanikawai* Ono 1997, p. 157, figs. 19–20. [female holotype from Iriomtejima Is., deposited in National Museum of Nature and Science, Tokyo, not examined]; Ono 2009, p. 80, figs. 38–40. **NEW SYNONYMY**

**Specimens examined.** ISHIGAKIJIMA IS. 7♀, Hirakubo (N24.59161 E124.31849), 28-X-2006 (5♀), 29-



**Fig. 6.** Receptacles, dorsal view. A-E, *Ryuthela iheyana* from Iheyajima Is.; F-Y, *Ryuthela sasakii* from Kumejima Is. Scale=0.5 mm.

XI-2011 (2♀). 2♀, Hirakubo (N24.56654 E124.30104), 28-X-2006. 8♀2♂, Hirakubo (N24.55715 E124.29220), 28-X-2006, one male was collected as juvenile and became adult on 31-X-2006. 3♀3♂, same locality, 29-X-2011, two males were collected as juveniles and became adult on 10-XI-2012. 2♀, Nosoko (N24.48117 E124.23577), 29-X-2006. 2♀1♂, Tozato (N24.45504 E124.23835), 30-XI-2011, male was collected as juvenile and became adult on 8-XII-2012. 2♀, Miyara (N24.43576 E124.21202), 29-X-2006. 1♀, Hirae (N24.41537 E124.19093), 29-X-2011. 1♀, Hirae (N24.41397 E124.19076), 29-X-2011. 1♀, Ishigaki (N24.37587 E124.15713), 29-X-2006. IRIOMOTEJIMA IS. 1♀, Iriomote (N24.38739 E123.75228), 24-V-2006. 1♀, Komi (N24.34300 E123.91141), 1-XI-2011. 1♀, Haiminaka (N24.31493 E123.84158), 25-V-2005. 1♀, Haiminaka (N24.30580 E123.85054), 1-XI-2011. 1♀, Haiminaka (N24.29813 E123.87680), 23-V-2006. 1♂, along Urauchi River, 18-VII-1996, T. Kuwada leg.

**Remarks.** Although Ono (1997) separated *R. tanikawai* from *R. ishigakiensis* by the shape of receptacles, there is a great variations in the shape as shown in Haupt (2003, figs. 53–54). In addition, the male palps of the specimens from Ishigakijima Is. and Iriomotejima Is. exactly agree with one

another (Figs. 2J–L, 3J–L, 4J–L). The specimens from these islands could not be separated by both female and male morphology. Thus *R. tanikawai* is newly synonymized with *R. ishigakiensis*.

By the shape of male palp, *R. ishigakiensis* can be easily separated from *R. nishihirai*, *R. iheyana* and *R. sasakii*. In distal view, retrolateral edge of contrategulum can be recognized as “double edge” in *R. ishigakiensis* (Figs. 2J–L, arrows 7), but not in others. This is due to the difference of the shape of contrategulum (Figs. 3A–L, 4A–L, arrows 8). In retrolateral view, contrategulum and tegulum are more widely apart in *R. ishigakiensis* than in others (Figs. 3A–L, arrows 9). The embolus of *R. sasakii* has a longitudinal constriction and looks like bifurcated (Figs. 3G–I, arrows 5), but not in *R. ishigakiensis* (Figs. 3J–L, arrows 10).

**Distribution.** Ishigakijima Is. and Iriomotejima Is., Ryukyu Is., southwest Japan.

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